1942 Gurevich, M. I. and Khaskind, M. [illegible]
flow around a slightly vibrating contour [illegible]
[illegible] 17, 3, 300 [illegible] Sept./Dec. 1953

Two dimensional [illegible] potential flow [illegible]
[illegible] light fluid is assumed. Mathemati[illegible]
[illegible] of conformal transformation [illegible]
contour coinciding with the vibrating contour at a certain
[illegible] assumed known [illegible]

[illegible]

M

Korshund, M. [illegible]

drical [illegible]

[illegible]

KHASKIND, M. D.

"The Hydrodynamics of the Rolling and Pitching of Ships." Dr Phys-Math Sci, Inst of Mechanics, Acad Sci, USSR, 16 Dec 54. (VM, 6 Dec 54)

Survey of Scientific and Technical Dissertations Defended At USSR Higher Educational Institutions (12)
SO: Sum. No. 556 24 Jun 55

14? Khazaind, M. D. [illegible]

[illegible] of the hydrodyn[illegible]

KHASKIND, M.D. and REMEZ, Yu.V.

"Metod Rascheta Khodkosti Sudov," Izvestiya Akademii Nauk SSSR, E Otdel. Tekhnicheskikh Nauk 1954 vyp. 12 str. 132 - 133.

3072. Remez, Yu. V., and Khaskind, M. D., Calculating the speed and motion of ships (in Russian), Izv. Akad. Nauk SSSR Otd. tekh. Nauk no. 12, 132-133, Dec. 1954.

USSR/Mathematics - Hydrodynamics

Card 1/1

Author : Khaskind, M. D.

Title : Wave motion of a heavy liquid

Periodical : Prikl. mat. i mekh., 18, 15-26, Jan/Feb 1954

Abstract : Solves the spatial problem of the wave motion of a heavy liquid caused by the vibration of bodies or the pulsation of singularities. Examines the planar-parallel waves generated by pulsating and non-stationary singularities in a heavy liquid.

Institution :

Submitted : February 6, 1953

HASKIND, Makh Danilovich

(Odessa Technological Inst of the Food and Refrigeration Industry) - Academic degree of Doctor of Physical Mathematical Sciences, based on his defense, 23 June 1955, in the Council of the Inst of Mechanics of the Acad Sci USSR, of his dissertation entitled: "Hydrodynamics of the Rocking of Boats."

Academic degree and/or title: Doctor of Sciences

SO: Decisions of VAK, List no. 27, 24 Dec 55, Byulletin' MVO SSSR Uncl. JPR /NY 548

KHASKIND, M. D.

"Certain Peculiarities in the Rolling of Ships and Its Damping," paper presented at Sci. Conf. in Leningrad in memory of Krylov, Nov. 1955.

USSR/Mechanics - Hydromechanics FD-2482

Card 1/1 Pub 85-9/19

Author : Khaskind, M. D.

Title : Non steady-state gliding along the excited surface of a heavy liquid

Periodical : Prikl. Mat. i Mekh., 19, 331-342, May-June 1955

Abstract : The author considers the plane problem of the vibrations of a weakly bent gliding contour along the surface of a heavy liquid for a given system of inflowing regular waves. For its solution he introduces a fuctional combination of a complex variable, whose determination reduces to the solution of an infinite system of equations relative to the coefficients of the series expansion of this function. He analyzes the solubility of this system and determines the perturbed wave motion of a heavy liquid and the hydrodynamic forces acting on the gliding surface.

Institution: --

Submitted : October 30, 1954

KHASKIND, M.D.

"Teoriya Soprotivleniya Sudov Pri Khode Na Volneniya," Trudy 3. Vsesoyuznogo Matemat. sezda Akademii Nauk SSSR, 1956, str. 159.

REMEZ, Yu.V. (Nikolayev); KHASKIND, M.D. (Odessa)

Approximate determination of the optimum size of ships. Izv.AN SSSR.Otd.tekh.nauk no.4:145-146 Ap '56. (MLRA 9:8)
(Shipbuilding)

KHASKIND, M.D.(Odessa).

Approximate method of evaluating the wave-resistance of elongated ships. Izv.AN SSSR.Otd.tekh.nauk no.10:108-112 O '56.

(MIRA 10:1)

(Waves) (Ship resistance)

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000721910011-9"

M. D.

5506* (Russian) Sedimentation [illegible] particles in Turbulent Flow. K teorii [illegible] tiazheloi chastitsy v turbulentnom potoke [illegible]
Izvestiia Akademii Nauk SSSR [illegible]
[illegible] 11, Nov 1956, p. 28-[illegible]

A theoretical study of the [illegible] flow [illegible] of a turbulent [illegible] and flow [illegible] motion of [illegible] of resistance.

3678. Khoskind, M. D., Unsteady motion of a solid in an accelerated stream of an infinite liquid (in [illegible]), [illegible] Mekh. 20, 1, 120-123, Jan./Feb. 1956.

Using well-known concepts and [illegible] [illegible] chap. VII in vectorial form [illegible] on the body are formally determined as functions of [illegible] stream and additive inertial terms.

KHASKIND, M.D. (Odessa)

Three-dimensional flow around thin bodies. Prikl.mat.mekh.20 no.2: 203-210 Mr-Ap '56. (Aerodynamics) (MLRA 9:7)

KHASKIND, M.D.

46-4-6/17

AUTHOR: Khaskind, M.D.

TITLE: Diffraction and Radiation of Acoustic Waves in Liquids and Gases. Part I (Difraktsiya i izlucheniye akusticheskikh voln v zhidkostyakh i gazakh. Chast' I)

PERIODICAL: Akusticheskiy Zhurnal, 1957, Vol.III, Nr 4, pp.348-359 (USSR)

ABSTRACT: The general theory of hydrodynamic forces acting on a body during diffraction and radiation of acoustic waves in liquids and gases is developed. The linear wave equation for the velocity potential is written down and solved subject to the boundary condition that on the surface of the body the normal derivative of the potential is equal to the normal component of the velocity at any point on the surface. For a solid body this normal component can be expressed in terms of the linear and angular velocities of the body. In addition to these boundary conditions the radiated and diffracted waves are subject, at infinity, to the condition that they go over into diverging waves. If the velocity potential is known then the pressure at any point can be

Card 1/3

46-4-6/17

Diffraction and Radiation of Acoustic Waves in Liquids and Gases. Part I.

expressed in terms of the time derivative of the potential. Once this is done the forces and moments acting on the body can be computed (Eq.5). The case is considered where the incident waves and the waves emitted by a vibrating body have the same frequency. The wave equation can then be reduced in the usual way to a time independent form. This time independent equation can then be solved and the solution expressed in the form of the Kirchoff integral subject to the usual boundary conditions on the surface of the body and at infinity. An asymptotic form is then obtained for the time independent wave function. The latter is then expanded in terms of the "radiation functions" which are defined by Eqs.(15)-(18). It is shown that diffraction and radiation problems can be solved in terms of these radiation functions. The special case of diffraction of spherical waves is then considered. Expressions are also derived for the damping coefficients. Another special case discussed is that of the oscillating cylindrical body. The above "radiation functions" and their asymptotic forms are discussed in detail and it is shown how they can be used in computing the moments and forces in any special case.

Card 2/3

46-4-6/17

Diffraction and Radiation of Acoustic Waves in Liquids and Gases. Part I.

There are 5 Russian references and 1 English.

ASSOCIATION: Odessa Technological Institute of the Food and Refrigeration Industry (Odesskiy tekhnologicheskiy institut, pishchevoy i kholodil'noy promyshlennosti)

SUBMITTED: December 29, 1956.

AVAILABLE: Library of Congress.

Card 3/3 1. Acoustic waves-Liquid-Diffraction 2. Acoustic waves-Liquid-Radiation 3. Mathematics-Theory

AUTHOR: Khaskind, M.D. (Odessa). 24-7-9/28

TITLE: Disturbance forces and degree of immersion of ships in presence of waves. (Vozmushchayushchiye sily i zalivayemost' sudov na volnenii).

PERIODICAL: "Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk" (Bulletin of the Ac.Sc., Technical Sciences Section), 1957, No.7, pp.65-79 (U.S.S.R.)

ABSTRACT: The case of arbitrary waves is considered and the general formulae are derived for the disturbance forces and the moments acting on the ship. It is shown that during radiation of diffracting waves, which can be characterised by a dipole source, concentrated pressure etc., the disturbing forces and moments can be determined more simply by radiation functions of the vessel which characterise the radiation of the waves in a heavy liquid during oscillation of the ship with unit speed amplitudes. In the case of diffraction of the regular system of travelling waves the forces and the moments and also the generalised damping coefficients are expressed solely by asymptotic characteristic radiation functions and their inter-relation is
1/2 established evaluating the degree of flooding of ships in presence of waves. The obtained results are applied for

KHASKIND, M.D., doktor fiz.-mat.nauk

Some characteristics of rolling and methods of controlling it.
Trudy NTO sud.prom. 7 no.2:61-71 '57. (MIRA 12:1)
(Stability of ships)

KHASKIND, M.D., doktor fiziko-matemat. nauk, prof.; KHOMENKO, V.S., aspirant

Electromagnetic oscillations in cylindrical magnetrons. Trudy OTIP i KHP 8 no.1:63-74 '57. (MIRA 12:8)

1. Kafedra fiziki Odesskogo tekhnologicheskogo instituta pishchevoy i kholodil'noy promyshlennosti.
(Magnetrons)

KHASKIND, M.D.

AUTHOR: Khaskind, M.D. (Odessa) 24-8-25/34

TITLE: Diffraction of progressive waves round a vertical barrier in a heavy liquid. (Difraktsiya begushchikh voln vokrug vertikal'noy pregrady v tyazheloy zhidkosti).

PERIODICAL: "Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk" (Bulletin of the Ac.Sc., Technical Sciences Section), 1957, No.8, pp.146-149 (U.S.S.R.)

ABSTRACT: A method is described for the determination of the forces and couples resulting from the diffraction of progressive waves round a vertical barrier in a heavy liquid. The barrier extends from the bottom of the liquid right up to its free surface. The forces and couples can be obtained from the asymptotic forms of the wave functions which describe the waves in the presence of barrier vibrations. General formulae are given and the special cases of a circular cylinder and a plane are considered in some detail. An approximate method is described for the calculation of the asymptotic forms of the wave functions for an arbitrary cross-section of the barrier.
There are 1 figure and 6 roferences, 4 of which are Slavic.

SUBMITTED: January 30, 1957.
AVAILABLE: Library of Congress

Card 1/1

KHASKIND, M. D.

AUTHOR: Khaskind, M. D. (Odessa) 24-9-10/33

TITLE: On the irreversible and non-equilibrium processes of compression and expansion in gas engines. (O neobratimykh i neravnovesnykh protsessakh szhatiya i rasshireniya v gazovykh mashinakh).

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1957, No.9, pp. 76-81 (USSR)

ABSTRACT: The non-steady state unidimensional motion is considered of a viscous and heat conducting gas in piston engines and an evaluation is made of the irreversible and non-equilibrium processes of compression and expansion of the gas as a function of its physical constants and its relative flow speed. In para.1 the processes of thermal conductivity and internal friction are considered, assuming that there is a heat inflow q per unit of mass of the gas per unit of time due to the heat conductivity and internal friction as expressed by eq.(1.1), p.76, based on the book "Mechanics of continuous media" by Landau, L.D. and Livshits, Ye. M., 1954. The results derived in para.1 show that in the processes of compression and expansion in the gas it is possible to completely disregard the irreversible phenomena of thermal conductivity and internal friction and, consequently, to consider the gas as being

Card 1/2

KHASKIND, M.D.

AUTHOR: KHASKIND, M.D. (Odessa) 40-4-20/24

TITLE: On the Suction Force of an Oscillating Wing in a Subsonic Flow (O podsasyvayushchey sile koleblyushchegosya kryla v dozvukovom potoke).

PERIODICAL: Prikladnaya Mat.i Mekh., 1957, Vol.21, Nr 4, pp.581-584 (USSR)

ABSTRACT: The author represents a theoretically carefully founded derivation of the well-known formula for the suction force of a wing which is flown on with subsonic velocity (see: Khaskind, Priklad.Mat.i Mekh.11,1,1947; translation No Ag-T-22, Air Mat. Com. and Brown University). New results are not presented.

SUBMITTED: January 12, 1957

AVAILABLE: Library of Congress

CARD 1/1

KHASKIND, M. D.

"Radiation an d Diffraction of Sound Waves in a Half-Space."

paper presented at the 4th All-Union Conf. on Acoustics, Moscow, 26 May - ~~2~~ 4 Jun 58.

46- 4-1-13/23

AUTHOR: Khaskind, M. D.

TITLE: Diffraction and Emission of Acoustic Waves in Liquids and Gases. Pt.II. (Difraktsiya i izlucheniye akusticheskikh voln v zhidkostyakh i gazakh. Chast' II.)

PERIODICAL: Akusticheskiy Zhurnal, 1958, Vol.IV, Nr.1, pp. 92-99.

ABSTRACT: Using Bernoulli's equation and carrying out calculations of pressure to the second order of small quantities, the author obtains general formulae for mean values of hydrodynamic forces and moments acting on a body on diffraction or emission (by that body) of acoustic waves in liquids and gases. These general formulae are illustrated by calculation for the special case of a solid circular cylinder in eccentric rotation. There are 5 figures.

ASSOCIATION: Odessa Technological Institute of Food and Refrigeration Industry (Odesskiy tekhnologicheskiy institut pishchevoy i kholodil'noy promyshlennosti.)

SUBMITTED: December 29, 1956.

Card 1/1 1. Bernoulli's equation—Applications 2. Sound—Diffraction —Mathematical analysis 3. Sound—Emission—Mathematical analysis 4. Sound—Pressure—Mathematical analysis

SOV/24-58-10-9/34

AUTHOR: Khaskind, M. D. (Odessa)

TITLE: Heat Transfer in the Ground Under the Insulation of Refrigerators (Teploperedacha v grunte pod izolyatsiyey kholodil'nikov)

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, 1958, Nr 10, pp 51-62 (USSR)

ABSTRACT: The problem considered is illustrated in Fig.1 and is formulated as follows: let L be the arbitrary contour of the outer boundary of the insulation of the base of a refrigerator, δ the thickness of the insulation and L_c the contour of the inner boundary of the base of the refrigerator. Let further $\theta^o(x, y)$ be the temperature in the insulation and $\theta(x, y)$ be the temperature in the ground, $\lambda_{И}$ and $\lambda_{Г}$ coefficients of thermal conductivity of the insulation and the ground, θ_c the temperature in the refrigerator, θ_o the mean temperature of the surrounding air, α_o and α_c

Card 1/4

APPROVED FOR RELEASE: 09/17/2001 CIA-RDP86-00513R000721910011-9"

SOV/24-58-10-9/34

Heat Transfer in the Ground Under the Insulation of Refrigerators

the emissivities of the surface of the ground and the floor of the base of the refrigerator. It is required to determine the function $\theta(x, y)$. This function is given by Laplace's equation:

$$\frac{\partial^2 \theta}{\partial x^2} + \frac{\partial^2 \theta}{\partial y^2} = 0 \qquad (1.1)$$

the boundary conditions being:

$$-\lambda_{\Gamma} \frac{\partial \theta}{\partial y} = \alpha_c(\theta - \theta_o) \quad \text{for} \quad y = 0, \ |x| > a \qquad (1.2)$$

$$-\lambda_{\Gamma} \frac{\partial \theta}{\partial n} = -\lambda_{И} \frac{\partial \theta^o}{\partial n}, \quad \theta = \theta^o \ \text{on } L \qquad (1.3)$$

The function $\theta^o(x, y)$ giving the distribution of temperature in the insulation is given by the analogous condition:

$$-\lambda_{И} \frac{\partial \theta^o}{\partial n} = \alpha_c(\theta^o - \theta_c) \quad \text{on} \quad L_c \qquad (1.4)$$

Card 2/4

SOV/24-58-10-9/34

Heat Transfer in the Ground Under the Insulation of Refrigerators

The solution obtained corresponds to the physically admissible continuous distribution of temperatures in the whole of the ground. Using this solution, it is possible to determine the depth of penetration of low temperatures into the ground and to estimate the thickness of the insulation corresponding to these temperatures. In a simplified form and in the special case where the base is absent, the problem was solved in Refs. 1 and 2, in which it was assumed that the temperature under the refrigerator is constant. Such a simplified problem leads to a temperature distribution which involves discontinuities and infinite heat flow. In the present paper a general solution of the problem is obtained. The possibility of the

Card 3/4

SOV/24-58-10-9/34

Heat Transfer in the Ground Under the Insulation of Refrigerators

presence of underground water is also taken into account. There are 4 figures and 6 references; 5 of the references are Soviet and 1 is French.

SUBMITTED: June 10, 1957.

Card 4/4

40-22-2-15/21

AUTHOR: Khaskind, M.D. (Odessa)

TITLE: Oscillations of a Grid of Thin Profiles in an Incompressible Stream (Kolebaniya reshetki tonkikh profiley v neszhimayemom potoke)

PERIODICAL: Prikladnaya matematika i mekhanika, 1958, Vol 22, Nr 2, pp 257-260 (USSR)

ABSTRACT: In another paper [Ref 1] the author investigated the oscillations of a biplane in an incompressible liquid and now in the present paper he refers to the calculation method developed in the other paper. The method is applied to the investigation of the disturbed afflux and to the hydrodynamic forces for the oscillation of thin grids. The investigated problem is directly connected with the research of the flow and of the forces in turbomachines. An approximative solution of the problem of the oscillating grid for which the oscillating grids are replaced by a system of discreet vortices was given by other authors, but it is not applied in this paper.

By a conformal mapping the field between two grids is mapped onto a simpler domain, and for this domain the author sets up in form of integrals the velocity potential of the flow under consideration of the boundary conditions. The complex

Card 1/2

40-22-2-15/21

Oscillations of a Grid of Thin Profiles in an Incompressible Stream

velocity potential:

$$w(z) = w_0(z) + w_1(z)$$

is separated into two parts, whereby the one part represents a flow around the grid free of circulation, while the other part corresponds to the solution of the homogeneous problem. There are 1 figure, and 3 references, 2 of which are Soviet, and 1 German.

SUBMITTED: January 9, 1956

1. Oscillations--Mathematical analysis 2. Turbines--Performance

Card 2/2

10(6) SOV/40-22-4-5/26

AUTHOR: Khaskind, M.D. (Odessa)

TITLE: Oscillations of a Thin Tandem Multiplane in a Plane Incompressible Flow (Kolebaniya tonkogo poliplana tandem v ploskom neszhimayemom potoke)

PERIODICAL: Prikladnaya matematika i mekhanika, 1958, Vol 22, Nr 4, pp 465 - 472 (USSR)

ABSTRACT: The author investigates the small oscillations of a tandem multiplane with thin profiles in a plane incompressible flow. The problem is subdivided into two simpler partial problems. In one of these partial problems the homogeneous problem is to be solved, to determine the flow of a system of wings without any circulation, while the second partial problem is a homogeneous task which is solved by means of functional set ups. The two partial problems are investigated with the means of the theory of thin wings, and the whole investigation finally leads to the determination of certain constants by means of linear equations.
More than half the volume of the paper is devoted to the investigation of oscillations of a tandem biplane. One of the two wings is considered to be fixed. The author gives appro-

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Oscillations of a Thin Tandem Multiplane in a Plane Incompressible Flow

SOV/40-22-4-5/26

ximative expressions for the hydrodynamic forces and for the energetic relations of this biplane system.
For the general case the calculation leads to extremely complicated integral equations. Also for the simpler case of the biplane there are carried out no evaluations of the general formula obtained.
There are 1 figure, 5 references, 3 of which are Soviet, and 2 German.

SUBMITTED: November 29, 1957

Card 2/2

KHASKIND, M.D.; KHOMENKO, V.S. (Odessa)

Profile streamlined by a supersonic constraint flow. Prikl. mat. i mekh. 22 no.6:815-818 N-D '58. (MIRA 11:12)
(Aerodynamics, Supersonic)

57-2-30/32

AUTHOR: Khaskind, M. D.

TITLE: On Some Regularities in the Electron Current in a Vacuum
(O nekotorykh zakonomernostyakh elektronnogo toka v vakuume)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp. 424-428
(USSR)

ABSTRACT: The methods of similarity and dimension are here employed for determining the rules governing an electron current of diodes. The employment of these simplest methods is completely natural in the present case and does not require any additional theoretical assumptions either (which are connected with the nature of the functional equations which express these phenomena). The general law which is obeyed by the volt-ampere characteristic of the electron current at the diodes, is determined. The same methods permit to indicate and to perform the analysis of the dependence in the saturation current, of the thermionic emission. The employment of the dimension method shows that the deviation of the volt-ampere characteristic of the electron current in vacuum from Langmuir's $V^{3/2}$ law as

Card 1/4

57-2-30/32

On Some Regularities in the Electron Current in a Vacuum

well in the presence as in the absence of initial velocities in the electrons leaving the cathode is important. That means that beside the initial velocities of the electrons other factors not taken into account in the existing theory of the $V^{3/2}$ law also are of great importance in the phenomenon investigated here. From the derived formula (9) is to be seen that beside the dependence on the presence of initial velocities of the electrons leaving the cathode the volt-ampere characteristic of the stream of electrons at the diodes is determined by the combination of two laws: the $V^{1/2}$ and the $V^{3/2}$ law. In order to check this formula (9) by way of experiment a diode in a pure shape (without grids) was investigated. It is shown that the linear law found (between z and c) corresponds to the experimental data in the investigated voltage-range at the anode with a high accuracy. It is shown that in dependence on the order of magnitude of the initial energy of the electrons different dependences for the diode-current in the surroundings of the very small and not too small V_a-values (anode-potential) are obtained. Finally the dependence of the saturation current of the thermoelectric emission is

Card 2/4

analyzed. Beginning with a certain V_a-value the sucking off of the entire cloud of electrons to the anode takes place. Therefore the intensity of the saturation current is dependent of: e (charge of the electron), m_e (mass of the electron), the work function A and the characteristic of the electron gas $\Theta = kT$ (k denoting the Boltzmann's constant, T the absolute temperature), as well as of Planck's constant h, as far as the electron gas in the case investigated here appears to be degenerated. Thus $i = f(e, m_e, A. h, \Theta)$. From these 6 dimensionless quantities three nondimensionless combinations are formed:

$$\xi = \frac{A}{\Theta}, \quad \eta = \frac{Ah^2}{m_e e^4}, \quad \zeta = \frac{ih^3}{em_e \Theta^2}$$

Therefore $\zeta = f(\xi, \eta)$. The experimental data show that the dependence ζ on ξ well obeys the exponential law and the following is obtained: $\zeta = f_o(\eta) e^{-\xi}$

There are 2 figures, and 2 references, all of which are Slavic.

57-2-30/32

On So.. Regularities in the Electron Current in a Vacuum

ASSOCIATION: Odessa Technological Institute of Food and Refrigeration Industries,

(Odesskiy tekhnologicheskiy institut pishchevoy i kholodil'noy promyshlennosti)

SUBMITTED: January 28, 1957

AVAILABLE: Library of Congress

1. Diodes-Electron current

Card 4/4

В. М. [illegible]

Эффективность и помехоустойчивость некоторых методов двукратной передачи сигналов

Н. М. Тихонов

Помехоустойчивость приемника по схеме Шоу

2. СЕКЦИЯ АНТЕННЫХ УСТРОЙСТВ

Руководитель А. Ф. [illegible]

9 июня

(с 10 до 16 часов)

В. Д. Кузнецов

Вопросы проектирования передающих антенн для телевидения и УКВ вещания

А. М. Модель,
Е. А. Анфимов

Антенно-фидерный тракт для радиорелейных линий, использующих рассеяние радиоволн в тропосфере

В. К. Пароманов

Антенна для линий связи с использованием явления ионосферного рассеяния

Я. Н. [illegible]

Диаграммы синфазных антенн бегущей волны

А. А. Метрусов

Исследование [illegible] для радиорелейных линий.

9 июня

(с 18 до 22 часов)

В. И. Андреенко,
Л. Д. Бахрах,
И. Е. Ефимова

К вопросу о влиянии [illegible] поверхности на диаграмму направленности излучателя, расположенного вблизи поверхности

В. А. Кошкин

О влиянии плоского диэлектрического клина на диаграмму направленности антенны

В. Н. Малиновский

Некоторые случаи рассеяния радиоволн [illegible] пластинкой

В. В. Гулеев

Дифракция электромагнитных волн на плоскости с периодическими поверхностными неоднородностями

М. Д. Косевич

Возбуждение поверхностных волн на плоских антеннах.

report submitted for the Centennial Meeting of the Scientific Technological Society of Radio Engineering and Electrical Communications im. A. S. Popov (VNORIE), Moscow, 8-12 June. 1959

KHASKIND, M.D.

16(1) PHASE I BOOK EXPLOITATION SOV/2660

Vsesoyuznyy matematicheskiy s"yezd. 3rd, Moscow, 1956

Trudy. t. 4: Kratkoye soderzhaniye sektsionnykh dokladov. Doklady inostrannykh uchenykh (Transactions of the 3rd All-Union Mathematical Conference in Moscow. vol. 4: Summary of Sectional Reports. Reports of Foreign Scientists) Moscow, Izd-vo AN SSSR, 1959. 247 p. 2,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Matematicheskiy institut.

Tech. Ed.: G.N. Shevchenko; Editorial Board: A.A. Abramov, V.G. Boltyanskiy, A.M. Vasil'yev, B.V. Medvedev, A.D. Myshkis, S.M. Nikol'skiy (Resp. Ed.), A.G. Postnikov, Yu. V. Prokhorov, K.A. Rybnikov, P. L. Ul'yanov, V.A. Uspenskiy, N.G. Chetayev, G. Ye. Shilov, and A.I. Shirshov.

PURPOSE: This book is intended for mathematicians and physicists.

COVERAGE: The book is Volume IV of the Transactions of the Third All-Union Mathematical Conference, held in June and July 1956. The book is divided into two main parts. The first part contains summaries of the papers presented by Soviet scientists at the Conference that were not included in the first two volumes. The second part contains the text of reports submitted to the editor by non-Soviet scientists. In those cases when the non-Soviet scientist did not submit a copy of his paper to the editor, the title of the paper is cited and, if the paper was printed in a previous volume, reference is made to the appropriate volume. The papers, both Soviet and non-Soviet, cover various topics in number theory, algebra, differential and integral equations, function theory, functional analysis, probability theory, topology, mathematical problems of mechanics and physics, computational mathematics, mathematical logic and the foundations of mathematics, and the history of mathematics.

Section on the Mathematical Problems of Physics

Card 21/34

SOV/179-59-2-7/40

AUTHOR: Khaskind, M. D. (Odessa)

TITLE: Theory of Resistance of Ships Moving Through Waves (Teoriya soprotivleniya sudov pri dvizhenii na volnenii)

PERIODICAL: Izvestiya Akademii nauk SSSR OTN, Mekhanika i mashinostroyeniye, 1959, Nr 2, pp 46-56 (USSR)

ABSTRACT: The formulae are given which describe the motion of a ship under various waving conditions. The general formula of calculating the forces of resistance when the volume of liquid is given as τ can be described by a system of coordinates forming the surfaces $\Sigma + C + S$ where Σ is a stationary surface described by the coordinates moving with the velocity equal to that of a ship u, S - surface of the ship, C - part of the free surface between S and Σ (figure on p 46), h - depth of the water basin. The motion of the liquid can be described by Eq (1.1), where $R + Zk$ - the main vector of hydrodynamic forces affecting the surface S, R - horizontal component of that vector, Z - lifting force, k - unit vector along the axis z, G - weight of the volume τ of the liquid, P - main vector of hydrodynamic forces of pressure acting from the outside of the liquid, Q - vector of quantity of motion, defined by Eq (1.2). The motion of particles of liquid is given as Eq (1.3) and the equation of

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weight of the volume τ as Eq (1.4), where τ_0 - volume of liquid described by the surfaces $S + C_0 + \Sigma$, $d\tau$ - volume of liquid above C_0 and g - gravity. Applying the Lagrange integral, the Eq (1.5) can be obtained and the value of $P + G$ is derived from Eq (1.6), where D - water displacement of the ship, L - profile obtained from the cross-section of the surface Σ, ζ - rise of free surface above the plane $z = 0$. From Eqs (1.1), (1.3) and (1.6) the formula (1.7) can be derived which determines the value of the main vector of hydrodynamic forces affecting the ship. If the surface Σ is represented as Σ_3 then the formula (1.8) is obtained from Eq (1.7). The expression (1.8) represents the exact formula which can be used when the velocity potential is known. This equation can be given in a linear form, Eq (1.9), from which the resistance of the ship Φ can be found as Eq (1.10), where Φ_0 - velocity potential of the diffracting waves, φ^0 - velocity potential on the surface S, and F - harmonic

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function. For the incoming waves Eqs (1.11), (1.12) and (1.13) are obtained from the formula (1.9). The functions F and Φ_0 become harmonic functions Eq (1.14) in the region τ_1 described by the surface Σ_1 which represents the surface of vertical cylinder. The horizontal forces of resistance can be found from Eqs (1.15) and (1.16). In the case of unsettled motion the resistance of the ship can be obtained from the general formula (1.17), and the mean value of resistance in steady motion can be derived from Eqs (1.9), (1.15), and (1.16). The potential velocity Φ (x, y, z, t) in this case can be given as Eq (2.1), where ζ_0 - the rise of the disturbed surface of the liquid. The mean forces affecting the ship in a disturbed sea of definite depth can be obtained from Eq (2.8). The analysis of the separate components of the force R can be made when the function Φ is written as Eq (2.9) where V and Ω - vectors of progressive and angle velocities, and the harmonic functions Φ_1 (φ_1, φ_2, φ_3), Φ_2(φ_4, φ_5, φ_6) and φ_7 are defined by the conditions (2.10), (2.11), (2.12). Thus the expression (2.20) can be derived from Eqs (2.21), (2.22) and (2.23). In the case of longer ships, the Eqs (2.24) and

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(2.25) can be applied. The verification of the results obtained can be carried out when a maximum resistance is calculated from Eq (2.28). Also, the formula (2.26) can be used if it is considered as a parallel to the phase velocity of the waves. Then Eq (2.29) can be applied. In the case of progressive motion of the ship, the formulae (1.15) and (1.16) take the forms (2.34) and (2.36). For the infinite depth of liquid the harmonic function $F(x, y, z)$ is defined as Eq (2.36), from which Eqs (2.37) and (2.38) are obtained. As an example, a case is described where $u = 0$ ($\lambda_1 = \infty$, $\lambda_2 = \nu$) and Eqs (2.40) to (2.42) become Eq (2.8) ($h = \infty$). Then, the resistance of the ship on quiet water ($r_0 = 0$, $\sigma = 0$, $\lambda_1 = \mu \sec^2 \theta$, $\lambda_2 = 0$, $\mu = g/u^2$) can be defined by Eq (2.43). The approximate formula in this case can be given Eqs (2.44), (2.45), where the function $H_7(\lambda, \theta)$ is

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defined by Eq (2.32) for $h \to \infty$, i.e. Eq (2.46). There is 1 figure and there are 10 references, of which 7 are Soviet and 3 are English.

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AUTHOR: Khaskind, M. D.

TITLE: The Freezing of Ground Under an Insulated Surface (Promerzaniye grunta pod izolirovannoy poverkhnost'yu)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 4, pp 782-785 (USSR)

ABSTRACT: In the present paper the generalized problem of the freezing of ground in the case of the existence of an insulating layer on its surface is investigated. Such a problem corresponds to the freezing of the ground beneath the insulation of a sufficiently broad cold storage house. The insulating layer is taken into account on the basis of the here introduced non-steady heat transfer coefficient. In the case of lacking insulation, and in the case of unlimited heat emission by a free surface, the problem investigated in the present paper is reduced to the usual formulation of Stefan's problem. The general solution is found by means of complete systems of orthogonal functions, in a similar way as in the case of the usual formulation of Stefan's problem. For the purpose of evaluating frost-depth in the upward direction, steadiness is assumed. According to the evaluation found,

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the insulating layer delays freezing of the ground considerably. The functions $\theta_s(y,t)(s = 0,1,2)$ determine the distribution of temperatures in the insulating layer of the thickness σ in frozen and in thawed ground. By considering these three media to be homogeneous, the following heat conductivity equations are obtained:

$\frac{\partial^2 \vartheta_s}{\partial y^2} = \frac{1}{a_s} \frac{\partial \vartheta_s}{\partial t}$ $(\vartheta_s = \theta_s - \theta^*;\ s = 0,1,2)$. Here θ^* denotes the temperature of ice formation in the ground; $a_o = a_u$, a_1 and a_2 are the temperature conductivity coefficients of the insulation of the frozen and of the thawed ground. Also the ranges of definition of these quantities are given. Next, the boundary conditions for the function ϑ_0 are given. For the purpose of eliminating the function $\vartheta_0(y,t)$ the symmetric solution of the heat conductivity equation for this function is used:

$$\vartheta_0(y,t) = C_1 + C_2\Phi\left(\frac{-y}{2\sqrt{a_u t}}\right), \quad \Phi(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-\tau^2} d\tau .$$

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Here C_1 and C_2 denote the integration constants. The calculation is followed step by step. By means of a transformation, the author then passes on to the functions u_1 and u_2, and represents the general solutions for these two functions in form of expansions in series according to complete systems of orthogonal functions. The equations resulting after some further steps may be solved by approximation by means of the reduction method, in which case the numerical methods for the integration of ordinary differential equations are used. Determination of such an approximated solution is quite the same as in the case of an ordinary Stefan problem. A formula for the frost depth is derived. In the case of an existing insulation the frost depth develops quite differently than if there is no insulation. There are 1 figure and 10 Soviet references.

ASSOCIATION: Odesskiy tekhnologicheskiy institut pishchevoy i kholodil'noy promyshlennosti (Odessa Technological Institute for the Food- and Refrigeration Industry)

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KHASKIND, M. D., and KHOMENKO, V. S. (Odessa)

"The Motion of Meteorites in the Ionosphere."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

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AUTHOR: Khaskind, M. D.

TITLE: Excitation of Surface Electromagnetic Waves on Flat Dielectric Coatings

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 2, pp 188-197 (USSR)

ABSTRACT: A conductive surface covered with a dielectric coating is investigated, and also the electromagnetic field above this surface excited by given sources. For solution of the problem, simplified boundary conditions are assumed on the surface of the dielectric coating, and a method is developed for determination of the complete wave field permitting the separation of the surface waves in a simple form. A general method is applied to the analysis of exciting surface waves by electric or magnetic dipoles, or their distributions. The results may

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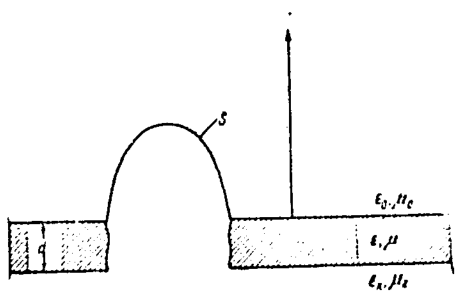
be used for improvement of computations for antennas of surface waves. (1) Formulation of Problem. A conductive surface is covered by a dielectric coating of thickness d, having dielectric constant and magnetic permeability ε and μ, respectively. In certain part limited by the surface S are located sources of an electromagnetic field (Fig. 1), whose time-variation intensities are expressed in terms



Card 2/21 Fig. 1.

of the exponential, exp ($i\omega t$), which will be hereafter omitted. The field strengths above the coating in vacuum are designated by **E** and **H**, but in the dielectric layer, by **E'** and **H'**. Then on the surface of the dielectric coating we have the usual conditions:

$$E_x = E'_x,\ E_y = E'_y,\ E_z = \varepsilon' E'_z,\quad H_x = H'_x,\ H_y = H'_y,\ H_z = \mu' H'_z \quad \text{for} \quad z = 0 \left(\varepsilon' = \frac{\varepsilon}{\varepsilon_0},\ \mu' = \frac{\mu}{\mu_0}\right) \tag{1}$$

On the conducting surface the boundary conditions of Leontovich are:

$$E'_x = -\rho_k H'_y,\ E'_y = \rho_k H'_x \quad \text{for} \quad z = -d \left(\rho_k = \left(\frac{\mu_k}{\varepsilon_k}\right)^{1/2}\right), \tag{2}$$

where ε_k and μ_k are complex permeabilities of the conducting medium. The practical rational system of units is used. In accordance with this ε_o and μ_o

exist in vacuum, but ε', μ', ε_k', μ_k' are relative values. In connection with the small thickness of the dielectric layer conditions, (1) and (2) can be simplified, eliminating the field in the dielectric. It is assumed that $knd \ll 1$, where $k = \omega \ (\varepsilon_o \mu_o)^{1/2}$ is the wave number in vacuum, and $n = (\varepsilon' \mu')^{1/2}$ is refraction coefficient. Expansions of **E'** and **H'** per z can be limited to the first two terms of the interval (0,-d), and the simplified boundary conditions now are:

$$\begin{aligned} E_x - d_0 \frac{\partial E_z}{\partial x} &= -\rho_0 (\rho_k + ikn^2 d_0) H_y, \\ E_y - d_0 \frac{\partial E_z}{\partial y} &= \rho_0 (\rho_k' + ikn^2 d_0) H_x \end{aligned} \quad \text{for } z = 0 \qquad (4)$$

$(d_o = d/\varepsilon', \quad \rho_o = (\mu_o/\varepsilon_o)^{1/2} = 120\ \pi \text{ ohm}).$

Determination of the excited electromagnetic field z = 0 is made by the electric and magnetic vectors of Hertz Π_e and Π_m, using the relations:

$$H = \frac{ik}{p_0}\,\mathrm{rot}\,\Pi_e, \qquad E = \mathrm{grad\,div}\,\Pi_e + k^2\Pi_e. \quad (5)$$

$$E = -ikp_0\,\mathrm{rot}\,\Pi_m, \qquad H = \mathrm{grad\,div}\,\Pi_m + k^2\Pi_m. \quad (6)$$

The sources are assumed to be directed along axes x and z (therefore $\Pi_{ey} = \Pi_{my} = 0$). Substituting (5) and (6) into (4), the conditions for components of Hertz vectors are for z = 0:

$$M_1\Pi_{ex1} = 0, \quad M_2\Pi_{ez} = \left(p_0 + \frac{1}{d_0}\right)\frac{\partial\Pi_{ex}}{\partial x}, \quad (7)$$

$$M_2\Pi_{mx} = 0, \quad M_1\Pi_{mz} = -(1 + p_0d_0)\frac{\partial\Pi_{mx}}{\partial x}, \quad (8)$$

where M_1 and M_2 are differential operators:

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$$M_1 = \frac{\partial}{\partial z} + p_0, \; M_2 = \left(\frac{\partial}{\partial z} + p_1\right)\left(\frac{\partial}{\partial z} + p_2\right), \; p_0 = -\frac{ik}{\rho_k' + ikn^2 d_0}. \qquad (9)$$

Here p_1, p_2 are roots of the characteristic equation:

$$p^2 + \frac{1}{d_0} p + \frac{ik}{d_0} \rho_k - k^2 (n^2 - 1) = 0, \qquad (10)$$

$$p_1 \simeq d_0 k^2 (n^2 - 1) - ik\rho_k', \; p_2 \simeq -\frac{1}{d_0} - d_0 k^2 (n^2 - 1) + ik\rho_k'. \qquad (11)$$

It is also $\mathrm{Im}\, p_0 < 0$, $\mathrm{Im}\, p_1 < 0$, $\mathrm{Im}\, p_2 > 0$, since $\mathrm{Re}\, \rho_k > 0$; $\mathrm{Im}\, \varepsilon \leqslant 0$ and $\mathrm{Im}\, \mu \leqslant 0$. For nonmagnetic metallic surfaces, the complex impedance $\rho_k' = 1/2 \; K\Delta(1 + i)$ where Δ = thickness of the skin-layer, and therefore in the centimeter range $|\rho_k'| \simeq 10^{-4}$. For an ideal dielectric

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layer the complex character of p_o, p_1, p_2 is very feebly marked, and they are close to actual values corresponding to an ideally conducting surface covered by an ideal dielectric. For the other limit $d_o = 0$ boundary conditions (7) and (8) determine the values of the Hertz vector for a given complex impedance ρ_k, and in particular the radiation of radio waves above the flat semiconductive earth in the approximated formulation of the boundary conditions of Leontovich. Boundary conditions (7) and (8) permit free solutions of the type:

$$f_0 = e^{-pz} g_0(x, y), \quad \Delta g_0 + (p^2 + k^2) g_0 = 0. \tag{12}$$

In the upper half-space ($z \geqslant 0$) only such solutions are physically permissible, which correspond to a characteristic number with a positive real part. These solutions determine the surface waves excited on the dielectric surface. From (9) and (11) it may be seen that for nonmagnetic surfaces ($\mu_k' = 1$), covered by an ideal dielectric, Re $p_o < 0$, Re $p_1 > 0$ and Re $p_2 < 0$.

Therefore the waves excited on these dielectric surfaces are connected with the characteristic number p_1. (2) Method of Surface Wave Separation. For determination of the complete wave field and separation of the surface waves, the auxiliary problem of determining function $\varphi(x, y, z)$, which is regular in the upper half-space outside the surface S, and satisfies the wave equation:

$$\Delta\varphi + k^2\varphi = 0 \tag{13}$$

and boundary condition:

$$\frac{\partial\varphi}{\partial z} + p\varphi = 0 \text{ at } z = 0 \quad (p = p_r + ip_i). \tag{14}$$

must be determined first. Another function f(x, y, z), satisfies the wave equation:

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$$\Delta f + k^2 f = 0 \quad (15)$$

and is connected with $\varphi(x, y, z)$ by the relation:

$$\frac{\partial \varphi}{\partial z} + p\varphi = \frac{\partial f}{\partial z}. \quad (16)$$

Condition (14) permits continuance of function f into the lower half-space by parity, and thus a regular single-valued function for the whole space beyond the surface S + S* is established, for which S* is the mirror image of surface S in the lower half-space, and the function f in infinity satisfies the radiation principle. The exact theoretical method is difficult, and therefore the author gives another method permitting an effective separation of the excited surface waves for an arbitrary magnitude of function f. Equation (16) is

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differentiated, and after using Green's formula, Equations (23) and (24) are derived:

$$\varphi = e^{-pz} \int_{\infty}^{z} e^{p\zeta} \frac{\partial f}{\partial \zeta} d\zeta \quad \text{at} \quad p_r < 0, \tag{23}$$

$$\varphi = e^{-pz} \int_{-\infty}^{z} e^{p\zeta} \frac{\partial f}{\partial \zeta} d\zeta + \varphi_0 \quad \text{at} \quad p_r > 0, \ \varphi_0 = \pm \frac{ip}{4} \iint_{S+S'} \left(\frac{\partial f}{\partial n} g_1 - f \frac{\partial g_1}{\partial n} \right) dS. \tag{24}$$

Function φ_0 in (24) characterizes the surface waves excited on the boundary $z = 0$. In the above formulas always $p_1 p_r \leqslant 0$, or Im $h \leqslant 0$, and therefore waves are propagated in all direction from the sources.

(3) Dipolar Excitation of Surface Waves. The Hertz function $\Pi^{(1)}_{ez}$ of the vertical electric dipole is determined in agreement with the simplified boundary conditions (4) by modifying (28):

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$$\Pi_{ez}^{(1)} = \frac{e^{-ikr_1}}{r_1} + \frac{e^{-ikr_2}}{r_2} + 2d_0 \frac{\partial}{\partial z} \frac{e^{-ikr_2}}{r_1} - 2p_1 e^{p_1 z} \int_{-\infty}^{z} \frac{e^{p_1 \zeta - ikr_2'}}{r_2'} d\zeta + \Pi_0 \qquad (30)$$

$$\Pi_0 = -2\pi i p_1 e^{-p_1 (z+z_0)} H_0^{(2)} (h_1 r_0). \qquad (31)$$

Now the horizontal electrical dipole in point B_0 (0,0,z) is considered, for which the Hertz vector $\Pi_e^{(2)}$ has two components $\Pi_{ex}^{(2)}$, and $\Pi_{ez}^{(2)}$, and the following expression in agreement with conditions (7) is given:

$$\Pi_{ex}^{(2)} = \frac{e^{-ikr_1}}{r_1} - \frac{e^{-ikr_2}}{r_2} + 2\left(\frac{i}{k} \rho_k' - n^2 d_0\right) \frac{\partial}{\partial z} \frac{e^{-ikr_2}}{r_2}, \qquad (32)$$

$$\Pi_{ez}^{(2)} = 2\left((n^2 - 1) d_0 - \frac{i}{k} \rho_k'\right) \frac{\partial}{\partial x} \frac{e^{-ikr_2}}{r_2}. \qquad (33)$$

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Analogously, following conditions (8) the components of the magnetic vector of Hertz Π_m are given:

$$\Pi_{mx}^{(1)} = 0, \ \Pi_{mz}^{(1)} = \Pi_{ex}^{(2)}, \ \Pi_{mx}^{(2)} = \Pi_{ez}^{(1)}, \ \Pi_{mz}^{(2)} = \Pi_{ez}^{(2)}, \tag{34}$$

where $\Pi_m^{(1)}$ and $\Pi_m^{(2)}$ are Hertz vectors of the vertical and horizontal magnetic dipoles. It follows from (30) to (34) that for given boundary conditions the surface waves are excited on the dielectric coating by the vertical electrical and the horizontal magnetic dipoles and their distributions. The waves excited by the horizontal electrical and vertical magnetic dipoles are of a considerably lower order, exceeding the exactness of the simplified boundary conditions (4). For $d_0 = 0$ and $Z_0 = 0$ formulas (32), (33) change to the known expressions of Hertz vector for a horizontal electrical dipole located

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on the surface of a semiconductive earth. It is of practical value to evaluate at which distance from the exciting sources the electromagnetic field transforms into the surface wave field. Under the assumption of $\beta_k = 0$, the distance at which practically the surface wave field only exists can be calculated from:

$$r_0 \gg \frac{k^{1/3}}{p_1^2}\left(\frac{h_1}{2\pi}\right)^{1/3}. \quad (37)$$

(4) Energy Relations. In order to determine how much of the radiated electromagnetic energy is concentrated in the surface waves, the average flow of electromagnetic energy through a vertical cylinder of a large radius r_0, standing with its base on the dielectric layer, shall be calculated. Using cylindrical coordinates r_0, θ, and z:

$$P_0 = \frac{1}{2} \mathrm{Re} \int_0^{l_0} dz \int_0^{2\pi} (E_0 H_z^* - E_z H_0^*) r_0 d\theta. \qquad (38)$$

where **E** and **H** are considered as in the zone of the surface waves, and therefore P_0 = average electromagnetic power transmitted by the surface waves. Simple linear distribution of the electromagnetic field sources and an ideal dielectric layer on an ideally conducting surface are further assumed (ρ_k' = 0 $p_1 > 0$). A vertical electrical vibrator above the layer produces only the vertical component of the Hertz electric vector Π_e:

$$\Pi_e = -\frac{i\rho_0}{4\pi k} \int_{a-l_1}^{a+l_1} I(z_0) \Pi_{ez}^{(1)}(r_0, z, z_0)\, dz_0, \qquad (39)$$

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where $I(z_0)$ = electrical current distribution function on the conductor section $a - l_1$, $a + l_2$);
$\Pi_{ez}^{(1)}$ = Hertz function of the vertical dipole per (30), (31). For the zone of surface waves asymptotically:

$$\Pi_e(r_0, z) = -\frac{ip_1 p_0}{4\pi k}\left(\frac{8\pi}{h_1 r_0}\right)^{1/2} N_e e^{-p_1 z - ih_1 r_0}, \tag{40}$$

$$N_e = \int_{a-l_1}^{a+l_2} I(z_0)\, e^{-p_1 z_0}\, dz_0.$$

From (5), (38) and (40) we have:

$$P_0 = \frac{p_1 h_1^2}{4k} \rho_0 |N_e|^2. \tag{41}$$

Similarly, in presence of magnetic currents I_m (x_0) distributed over the section $(-l, l)$, parallel to axis x relations per:

$$P_0 = \frac{p_1}{8\pi k \rho_0} \int_0^{2\pi} |N_m(\theta)|^2 (p_1^2 \cos^2\theta + k^2 \sin^2\theta)\, d\theta,$$

$$N_m = e^{-p_1 y_0} \int_{-l}^{l} I_m(x_0)\, e^{ih_1 (x_0 \cos\theta + y_0 \sin\theta)}\, dx_0, \qquad (42)$$

can be established where y_0, z_0 are coordinates of a point through which passes the horizontal section of magnetic current. For a symmetrical vibrator with $l_1 = l_2 = l$, it can be assumed within the scope of usual conditions that $I(u) = I_0 \sin k(l - |u|)$ $(u = z_0 - a)$ and in agreement with this for the asymptotic characteristic N_e it can be written:

$$N_e = \frac{2}{h_1^2} I_0 e^{-p_1 a} \left(k (\cos kl - \cos 2kl \operatorname{ch} p_1 l) + p_1 \sin 2kl \operatorname{sh} p_1 l\right). \qquad (43)$$

As a definite example for the half-wave vibrator $k\,l = \pi/2$) located closely above the dielectric layer ($a \simeq$), from (41) and (43) the radiation resistance of the surface waves can be written as:

$$R_0 = \frac{2P_0}{I_0^2} = 60\pi \frac{\alpha^2}{1+\alpha^2}(1+e^{-\pi\alpha})^2 \quad \left(\alpha = 2\pi \frac{d_0}{\lambda}(n^2-1)\right). \qquad (44)$$

Calculations prove the maximum of R_0 to be of the order of 120 ohms in the range of small values of $d\lambda$ (approx. $d_0/\lambda \simeq 0.075(n^2 - 1)^{-1}$ for which a polystyrene layer ($\varepsilon' = 2.6$, $\mu' = 1$) has $d/\lambda \simeq 14$. The high magnitude of radiation resistance of the half-wave vibrator indicates that in the immediate vicinity of the vibrator the electromagnetic field changes to the field of surface waves. The indicated extreme value of the inequality (37) gives

$r_{\cdot}/\lambda \gg 0.4$. Actually, however, the current distribution accelerates the transition to surface waves, and from an analogous criterion it may be ofund that $r_o\lambda \gg 0.25$. Thus, already at $r_o = \lambda$, the surface wave amplitude exceeds by several times the space wave amplitude propagated along the dielectric layer. Comparision of radiation resistance of surface waves to full resistance of the radiation: For the case of a vertical electrical vibrator, the complex power is:

$$P_n = -\left[I^* \frac{\partial \Pi_e(0, z)}{\partial z} - \frac{\partial I^*}{dz} \Pi_e(0, z)\right]_{z=a-l_1}^{z=a+l_1}. \qquad (45)$$

The values of $\Pi_e(r_o, z)$ for $r_o \neq 0$ are determined by (39), (30), (31). To find Π_e for $r_o = 0$, we can consider p_1 as complex, and develop the equations:

$$\Pi^{(1)}_{ez}(0, z, z_0) = \Pi_1 + \Pi_2 + \Pi_3,\ \Pi_1 = \frac{e^{-ik|z-z_0|}}{|z-z_0|},\ \Pi_2 = \frac{e^{-ik(z+z_0)}}{z+z_0},$$

$$\Pi_3 = 2d_0 \frac{\partial}{\partial z} \frac{e^{-ik(z+z_0)}}{z+z_0} - 2p_1 e^{-p_1(z+z_0)} \int\limits_{\infty}^{z+z_0} \frac{e^{(p_1-ik)t}}{t}\, dt. \quad (46)$$

The meaning of the separate addends is clear. Π_3 can be more simply approximated by:

$$\Pi_3 = 2d_0 \frac{\partial}{\partial z} \frac{e^{-ik(z+z_0)}}{z+z_0} - 2p_1 Ei\,[-ik(z+z_0)],$$

$$Ei\,(-ix) = \int\limits_{\infty}^{x} \frac{e^{-iu}}{u}\, du = ci\,(x) - isi\,(x). \quad (47)$$

From (45), (46), (47), the total complex resistance of the vibrator can be determined as:

$$Z = Z_1 + Z_2 + Z_3, \quad (48)$$

where Z_1 = vibrator resistance in free space; Z_2 = resistance caused by the ideally conductive surface. The magnitude of Z_3 gives the influence of the dielectric layer and of the finite conductivity of the plane. The expressions for Z_1 and Z_2 are well-known, but the resistance Z_3 can be expressed through integral sine or cosine and elementary functions. In particular for a half-wave vibrator:

$$
\begin{gathered}
Z_3 = -60i\,(kd_0(n^2-1) - i\rho'_k)\,H_1 + 30i\,(kd_0n^2 - i\rho'_k)\,H_2, \\
H_1 = Ei\,(-iu_1) + 2Ei\,(-iu_0) + Ei\,(-iu_{-1}), \\
H_2 = e^{-iu_0}\left(\ln\frac{u_0}{u_{-1}} - \ln\frac{u_1}{u_0}\right) + e^{iu_0}\,(2Ei\,(-2iu_0) - Ei\,(-2iu_1) - Ei\,(-2iu_{-1})), \\
u_1 = \pi\left(4\,\frac{a}{\lambda} + 1\right),\ u_0 = 4\pi\,\frac{a}{\lambda},\ u_{-1} = \pi\left(4\,\frac{a}{\lambda} - 1\right).
\end{gathered}
\tag{49}
$$

Assuming $d_0 = 0$ in (49), we get the value of Z_3 for a half-wave vibrator located above a semiconductive medium, which was analyzed previously, but with incorrect results (U. L. Barrou, Impedance of a vertical half-wave antenna above earth, of finite conductance, design and calculation of antennas, Sb. statey, Gosudarstvennoye izdatel'stvo po tekhnike svyazi, 1936, 70-76). There are 2 figures; and 7 Soviet references.

SUBMITTED: May 29, 1959

KHASKIND, M. D.

"Some Problems of Heat Transfer Through Insulation Into
Heat Conductive Media."

Report submitted for the Conference on Heat and Mass Transfer, Minsk, BSSR, June 1961.

KHASKIND, M.D.

Structural dependence of the filtration speed from the hydraulic gradient. Gidrotekhnika no.1:46-48 '61. (MIRA 15:3)
(Seepage)

24461

S/109/61/006/006/002/016
D204/D303

9.9000

AUTHOR: Khaskind, M.D.

TITLE: The propagation of electromagnetic waves over a gyrotropic medium

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 6, 1961, 886 - 894

TEXT: The author analyzes first a flat discontinuity plane between the free space and a homogeneous absorbing anisotropic medium. The approximate expression for the components of an electromagnetic field propagated over an absorbing anisotropic medium is given, the general expression being derived in full in L.D. Landau, and Ye.M. Lifshits (Ref. 1: Elektrodinamika sploshnykh sred, GIFML, 1959, p. 397). The approximate boundary conditions obtained thus are useful since they define the properties of reflections of plane waves and in particular show that the linearly polarized plane waves, incident on to an anisotropic plane, become elliptically po-

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The propagation of ... S/109/61/006/006/002/016
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larized plane waves, incident on to an anisotropic plane, become elliptically polarized. The author then derives equations for E-polarization with the corresponding equations for H-polarization (Figs. 1 + 2).

Fig. 1.

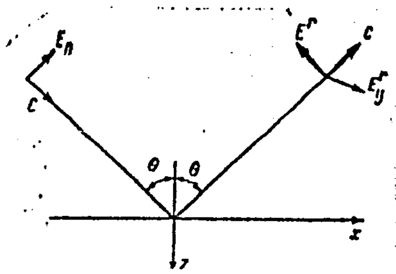
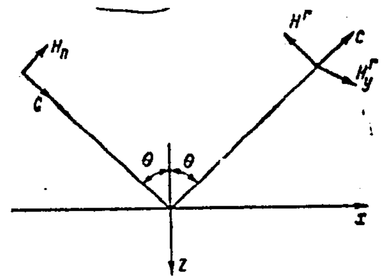


Fig. 2.



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These equations prove qualitatively the characteristics of propagation of long radiowaves which after reflection from the ionosphere are elliptically polarized. Next the coefficients f_{pq} are derived for the gyrotropic electron plasma. For transverse magnetization of the plasma the dielectric tensor $\hat{\varepsilon}'_z$ is given as cited by Ya.L. Al'pert, V.L. Ginzburg, Ye.L. Feynberg (Ref. 2: Rasprostraneniye radiovoln (Radiowave Dispersal) GTTI, 1953, pp. 326, 152-157)

$$\hat{\varepsilon}'_z = \begin{pmatrix} \xi & i\eta & 0 \\ -i\eta & \xi & 0 \\ 0 & 0 & \varepsilon'_e \end{pmatrix},$$

$$\xi = 1 + \frac{q^2(1-is)}{\sigma^2-(1-is)^2}, \quad \eta = \frac{\sigma q^2}{\sigma^2-(1-is)^2}, \tag{13}$$

$$\varepsilon'_e = 1 - \frac{q^2}{1-is}, \quad s = \frac{\nu}{\omega}, \quad \sigma = \frac{\omega_H}{\omega},$$

$$q = \frac{\omega_p}{\omega}, \quad \omega_p^2 = \frac{Ne^2}{m_e\varepsilon_0}, \quad \omega_H = \frac{eB_0}{m_e}.$$

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Here e and m - charge and mass of the electron respectively; $B_0 = \mu_0 H_0$ - magnetizing field induction; ν - number of electron collisions with heavy particles in a unit time; ω_p - plasma frequency, ω_H - hydromagnetic frequency; N - free electrons concentration. The author analyzes next the electromagnetic field induced over a gyrotropic plane by elementary radiators. Since the determination of the longitudinally magnetized field is very complex, only the transverse magnetized field is considered in the article and after a series of equation operations arrives at the fields of longitudinally radiating electrical and magnetic sources as given by Eqs.

$$\Pi_{ex}^{(3)} = \Pi_{mz}^{(2)}, \quad \Pi_{mx}^{(3)} = -\Pi_{mz}^{(1)}, \quad \Pi_{ez}^{(3)} = -\frac{\rho_0}{iks_0}\frac{\partial \Pi_{mx}^{(3)}}{\partial x}, \quad \Pi_{mz}^{(3)} = 0, \qquad (40)$$

and

$$\Pi_{ex}^{(4)} = -\Pi_{ez}^{(2)}, \quad \Pi_{mx}^{(4)} = \Pi_{ez}^{(1)}, \quad \Pi_{ez}^{(4)} = 0, \quad \Pi_{mz}^{(4)} = -\frac{1}{ik\rho_0 s_0}\frac{\partial \Pi_{ex}^{(4)}}{\partial x}, \qquad (41)$$

in which $\Pi_e^{(3)}$, $\Pi_m^{(3)}$ and $\Pi_e^{(4)}$, $\Pi_m^{(4)}$ - are hertzian vectors of the longitudinally radiating electric and magnetic sources respectively. In the last part of the article the author analyzes reflection and attenuation. The definite integrals given by the author for hertzian vectors have the same shape as in the particular case of propagation of radiowaves over a semi-conducting earth. This fact permits the same approximate methods of analysis of radiowave propagation to be applied as given in Ref. 2 (Op.cit.) to obtain the reflection formulae and attenuation functions in the present problem. The author obtains

$$\Pi_{ez}^{(1)} = \frac{e^{-ikr_0}}{r_0} V_e^{(1)}, \quad \Pi_{mz}^{(1)} = \frac{e^{-ikr_0}}{\rho_0 r_0} V_e^{(2)},$$

$$\Pi_{mz}^{(2)} = \frac{e^{-ikr_0}}{r_0} V_m^{(1)}, \quad \Pi_{ez}^{(2)} = \rho_0 \frac{e^{-ikr_0}}{r_0} V_m^{(2)}, \qquad (50)$$

where V_e and V_m are attenuation functions determined by

$$V_e^{(1)} = 1 + \frac{1}{p_1 - p_2}\left(\left(p_1 - \frac{1}{r}\right)L(x_1) - \left(p_2 - \frac{1}{r}\right)L(x_2)\right),$$

$$V_e^{(2)} = V_m^{(2)} = -\frac{s_0}{p_1 - p_2}\left(L(x_1) - L(x_2)\right) \qquad (x_{1,2} = x(p_{1,2})), \tag{51}$$

$$V_m^{(1)} = 1 + \frac{1}{p_1 - p_2}\left(\left(p_1 - r - \frac{g^2}{r}\right)L(x_1) - \left(p_2 - r - \frac{g^2}{r}\right)L(x_2)\right).$$

in which dimensionless $x_{1,2}$ may be considered as "numerical" distances in the gyrotropic[1,2] case. If $/X_{1,2}/ \gg 1$ then integrating by parts,

$$L(x) = 1 + \frac{1}{2x} + \frac{3}{4x^2} + \ldots .$$

is easily obtained and hence the asymptote of

$$V_e^{(1)} = -\frac{1 + g^2}{x_0 r^2}, \quad V_e^{(2)} = V_m^{(2)} = -\frac{g(g^2 + r^2 + 1)}{x_0 r^2},$$

$$V_m^{(1)} = \frac{1 - (g^2 + r^2)(g^2 + r^2 + 1)}{x_0 r^2} \qquad (x_0 = -ikr_0), \tag{52}$$

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The propagation of ...

[illegible] which shows that in the case of a gyrotropic plane the field intensity decreases as r_0^{-2} or in the same manner as if [illegible] over an isotropic absorbing surface. There are 3 figures [illegible] references.

SUBMITTED: May [illegible], 19[illegible]

Card [illegible]

KHASKIND, M.D.

Propagation of sound and electromagnetic waves in half-space.
Akust.zhur. 5 no.4:464-471 '59. (MIRA 14:6)

1. Odesskiy tekhnologicheskiy institut pishchevoy i kholodil'noy promyshlennosti.
(Sound waves) (Electromagnetic waves)

KHASKIND, M.D.

Temperature field in the ground near an insulated cylindrical heat-transfer agent. Inzh.-fiz.zhur. 4 no.6:83-89 Je '61.
(MIRA 14:7)

1. Elektrotekhnichskiy institut svyazi, Odessa.
(Heat—Transmission)

KHASKIND, M.D.

Propagation of electromagnetic waves over a gyrotropic medium. Radiotekh.i elektron. 6 no.6:886-894 Je '61. (MIRA 14:6)
(Electromagnetic waves)

KHASKIND, M.D.

Wave excitation on an impedance plane. Radiotekh. i elektron 6 no 8:1259-1272 Ag '61. (MIRA 14:7)
(Electromagnetic waves)

30293

S/109/61/006/011/008/021
D246/D305

9.1310

AUTHOR: Khaskind, M.D.

TITLE: Diffraction of waves on a slit and a film, oriented perpendicular to the impedance plane

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 11, 1961, 1859 - 1870

TEXT: This is based on analyses published by the author in earlier papers; The author works out in detail problems outlined in his papers (Ref. 3: Radiotekhnika i elektronika, 1961, 6, 8, 1259). First he investigates the diffraction of plane waves on a rectangular slit between a conducting and an impedance plane which are mutually perpendicular. The conditions for functions f(y, z) and φ(y, z), introduced in previous papers, become

$$\frac{\partial f}{\partial z} = \frac{\partial \varphi_0}{\partial z} + p\,\varphi_0 \text{ at } y = 0,\ 0 < z < b;$$

$$\frac{\partial f}{\partial y} = 0 \text{ at } y = 0,\ b < z < \infty; \qquad (12)$$

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$$\frac{\partial^2 f}{\partial y \partial z} = 0 \text{ at } y = 0,\ b < z < \infty.$$

For an interval of the z-axis, between -b and b, not intersecting the contour L + L* one can obtain the complex amplitude 4

$$A(\pm h, p) = \int_{-b}^{b} \frac{\partial f^+}{\partial y} e^{pz} dz \quad \left(\frac{\partial f^+}{\partial y} = \left(\frac{\partial f}{\partial y}\right)_{y=+0}\right). \tag{13}$$

Then one can obtain an expression for the full surface current density:

$$i_z = i_z^+ + i_z^- = 2k^2\left[\varphi_0(0, z) - e^{-pz}\left(\varphi_0(0, b)\, e^{pb} + \int_b^z e^{pz} \frac{\partial f}{\partial z} dz\right)\right]. \tag{16}$$

and the complex power

$$P_k = i\rho_0 k^3 \frac{ik \sin\beta^*}{ik \sin\beta^* + p} \int_{-b}^{b} \frac{\partial f^+}{\partial y} e^{ikz \sin\beta^*} dz \tag{19}$$

and the total potential V, applied to the edges of the slit

$$V = \int_0^b E_z(0, z)\, dz = ik\rho_0 \int_0^b \frac{\partial f^+}{\partial y} e^{\nu z}\, dz. \tag{21}$$

To determine function f, the author introduces the ellyptical coordinate system and notes that the particular solutions of the wave equation in this system are products of even and odd Matier functions. Hence, one may determine function f:

$$f = \sum_{n=0}^{\infty} a_n \frac{Ce_n(\xi)}{Ce_n(0)} ce_n(\eta), \quad a_n = \sum_{m=0}^{\infty} A_{nm} d_m^{(1)},$$
$$d_m^{(1)} = \frac{1}{\pi} \int_{-\pi}^{\pi} U(b \cos \eta) \cos m\eta\, d\eta. \tag{25}$$

Also the complex amplitude, power and potential can be similarly determined, using the formulae quoted above. This solution is applicable only for the case $kb \ll 1$ and $kb \sim 1$, but then the treatment can be simplified, for example:

$$f = a_0 \xi + \text{const.} \tag{41}$$

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$$A(\pm h, p) = \pi a_0 I_0(\nu) \quad (\nu = pb). \tag{43}$$

If the power is divided into the active and reactive, it results that the whole active power is used to generate the surface waves. Fig. 2 shows the coefficient of transmission of the surface waves, D_0 as a function of ν for various $\beta_0 = k/h$ (the coefficient of retardation). When Kirchhoff's approximation is used

$$\frac{\partial \varphi^+}{\partial y} \simeq - ihe^{-pz} \text{ which gives } D_0 \simeq 1 - e^{-2\nu},$$

4

the resultant curve is shown with broken lines. The same analysis is applied to the case, when any given field $/\varphi_0(y, z)/$ is falling on an ideally conducting film which is perpendicular to the impedance plane. The boundary condition here is the following:

$$\frac{\partial \varphi}{\partial y} = \frac{\partial \varphi_0}{\partial y} \text{ at } y = 0,\ 0 < z < b. \tag{53}$$

For the limiting case, $kb \ll 1$, function f becomes

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Diffraction of waves on a slit ...

Fig. 2.

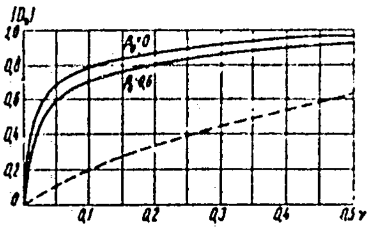

Рис. 2

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Diffraction of waves on a slit ...

$$f = bC_2 e^{-\xi} \sin\eta \qquad (70)$$

and the complex amplitude

$$A(\pm h, p) = \pm \pi i \frac{h}{p} C_2 I_1(\nu), \quad C_2 = \frac{1}{b} \frac{1}{ph^{-1}K_1(\nu) + \pi i I_1(\nu)}. \qquad (71)$$

It follows from the curve that only when the effective height Δ = 1/p is less than 2/3 of the width of the film, does one have the full reflection of the surface waves. There are 8 figures and 12 references: 8 Soviet-bloc and 4 non-Soviet-bloc. The reference to the English-language publication reads as follows: G. Blanch, H.E. Fettis, Subsonic oscillatory aerodynamic coefficients computed by the method of Reissner and Haskind, J. Aeronaut. Sci., 1953, 20, 12, 851.

SUBMITTED: November 21, 1960

Card 5/6

34031
S/109/62/007/001/009/027
D201/D301

9.3700 (1057)

AUTHOR: Khaskind, M.D.

TITLE: Diffraction of waves at a tape placed along an impedance plane

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 1, 1962, 78-89

TEXT: The author analyzes the diffraction of E-waves at a rectilinear ideally conducting tape placed at an impedance plane. The electromagnetic field over an impedance plane Z = 0 is analyzed by means of the Hertz magnetic vector $\Pi_m = \varphi(y, z)X_1^0$. The function is presented in the form

$$\varphi = \Psi + \varphi_0 \quad (3)$$

where function φ_0 determines the given field of incident waves and function Ψ - determines the field of dispersion waves. The dispersion field is analyzed by introducing a functional combination

$$\frac{\partial \Psi}{\partial z} + p\Psi = \frac{\partial f}{\partial z}, \quad (4)$$

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Diffraction of waves at a tape ...

in which function f satisfies condition

$$\frac{\partial f}{\partial z} = 0 \text{ at } z = 0. \qquad (5)$$

The author then uses the results obtained by him earlier, in which inverse transition over to function $\Psi(z, y)$ was given as

$$\Psi = f + \frac{p}{2hi}\left(e^{ihy}\int_{\infty}^{y} e^{-ihy}\left(\frac{\partial f}{\partial z} - pf\right)dy - e^{-ihy}\int_{\infty}^{y} e^{ihy}\left(\frac{\partial f}{\partial z} - pf\right)dy\right)$$

$$(h^2 = k^2 + p^2), \qquad (6)$$

to show that the problem of determining the diffraction of waves over a rectilinear ideally conducting tape at an impednace plane reduces to determining the coefficients of the resolution of function f into an infinite system of linear equations

$$f = \sum_{n=0}^{\infty} a_n Ce_n(\xi) ce_n(\eta). \qquad (26)$$

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Diffraction of waves at a tape ... S/109/62/007/001/009/027
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Eq. (26) is obtained by introducing an elliptical system of coordinates

$$y = a\ \mathrm{ch}\,\xi \cos \eta, \quad z = a\ \mathrm{sh}\,\xi \sin \eta \qquad (22)$$

and by using particular solutions of the wave equation $\varphi_n^{(2)} = Ce_n(\xi)$ $Ce_n(\eta)$ $(n = 0, 1, \ldots)$, where $Ce_n(\eta)$ - the even Mathieu functions. The results obtained are used for numerical analysis of limiting cases. There are 8 figures and 14 references: 10 Soviet-bloc and 4 non-Soviet-bloc. The reference to the English-language publication reads as follows: G. Blauch and H.E. Fettis, Subsonic oscillatory aerodynamic coefficients computed by the method of Reissner and Haskind, J. Aeronaut. Sci., 1953, 20, 12.

SUBMITTED: November 28, 1960

Card 3/3

34487
S/109/62/007/002/004/024
D201/D303

9,9600

AUTHOR: Khaskind, M.D.

TITLE: Scattering of electromagnetic waves in meteor trails

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 2, 1962, 206 - 222

TEXT: The author applies the approximate methods of the theory of material wave scattering to the problem in question. It is assumed that the electron concentration n in the ionized meteorite trail is an exponentially decreasing function of distance from its axis. The analysis of dispersion of normally incident electromagnetic waves can be then reduced to determining only one of the components E_x and H_x for TM- and TE- waves respectively. The use of approximate expressions for the distribution function of electron concentration cannot, however, be made to the same extent. For a TM-wave, the approximating radius r_c cannot be determined in the same manner for all instants and the structure of this dependence is totally different for the short and long-wave cases. The author represents the

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equation for E_x in a form coinciding with Schrödinger's equation with the aid of which the dispersion of matter waves in a cylindrical region can be characterized. The dispersion amplitude and phase shift are determined. Approximating the ionized track by a cylinder of radius r_c, the author obtains the external (E_x, H_x) and internal (E_{ix}, H_{ix}) components satisfying the boundary conditions which to some extent compensate for the transition from a smooth continuous electron distribution to its step-wise representation. Eventually it is shown that under the influence of the earth's magnetic field at heights more than 100 km, noticeable anisotropy of diffusion may take place which results in the disturbance of symmetry of distribution of electron concentration around the axis of the trail. The reflection of radio waves from such anisotropic trails is studied and an expression for the reflection coefficient obtained. The reflected signal is found to be dependent on angle β, formed by the axis of the main trial and that of the anisotropic reflecting position of it and on angle θ_0 -- formed by the direction of the incident wave vector and y axis. It is stated that for these heights more accurate processing of experimental data is required in comparison with requirements of previously derived formulae. There are 4 figures and 9 references: 5 Soviet-bloc and 4 non-Soviet-bloc. The references to the English-language publications read as follows: T.R. Kaiser, R.L. Closs, Theory of radio reflections from meteor trails, Philos. Mag., 1952, 43, 7, 1; N. Herlofson, Plasma resonance in ionispheric irregularities, Arkiv. fys., 1951, 3, 15, 247; G. H. Keitel, Certain mode solutions of forward scattering by meteor trails, Proc. I.R.E., 1955, 43, 10, 1481.

SUBMITTED: April 3, 1961

9,9600

S/109/62/007/002/018/024
D201/D303

AUTHOR: Khaskind, M.D.

TITLE: Attenuation function of radiowaves scattered at the meteor trails

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 2, 1962, 343 - 345

TEXT: The problem of normally incident to the long-lasting ionized meteor trail radiowave scattering reduces to solving an integral equation (Ref. 1: M.D. Khaskind, Radiotekhnika i elektronika, 1962, 7, 2, 206). It is found that the ratio of intensity of scattered waves to the density of incident intensity (denoted by Q and called the scattering radius) is equal to 0 for the first Born approximation to the solution. The author deduces the second Born approximation and obtains an approximate expression for Q. There are 2 references: 1 Soviet-bloc and 1 non-Soviet-bloc.

SUBMITTED: July 10, 1961

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B

KHASKIND, M.D.

Wave excitation above a plane crested structure. Akust. zhur. 7 no.3:366-369 '61. (MIRA 14:9)

1. Odesskiy elektrotekhnicheskiy institut svyazi.
(Waves) (Boundary value problems)